1	OSHA R. MESERVE (SBN 204240)		
2	PATRICK M. SOLURI (SBN 210036) SOLURI MESERVE, A LAW CORPORATION 510 8th Street		
3	Sacramento, California 95814		
4	Telephone: (916) 455-7300		
5	Facsimile: (916) 244-7300 Email: osha@semlawyers.com		
6	patrick@semlawyers.com		
7	Attorneys for Local Agencies of the North Delta	a a constant of the constant o	
8	THOMAS H. KEELING (SBN 114979) FREEMAN FIRM		
9	1818 Grand Canal Boulevard, Suite 4		
10	Stockton, CA 95207 Telephone: (209) 474-1818		
11	Facsimile: (209) 474-1245		
12	Email: tkeeling@freemanfirm.com		
13	Attorneys for Protestants County of San Joaquin,		
14	San Joaquin County Flood Control and Water Conservation District, and Mokelumne River Water		
	and Power Authority		
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16	BEFORE THE		
17	CALIFORNIA STATE WATER RESOURCES CONTROL BOARD		
18	HEARING IN THE MATTER OF	TESTIMONY OF EDASED SUILLING DED	
19	CALIFORNIA DEPARTMENT OF WATER	TESTIMONY OF FRASER SHILLING, Ph.D.	
20	RESOURCES AND UNITED STATES	LOCAL AGENCIES OF THE NORTH DELTA	
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TESTIMONY OF FRASER SHILLING, Ph.D.

I. INTRODUCTION

As a biologist, ecologist and environmental scientist, my educational, teaching and research experience has been varied, providing me with the breadth and depth necessary to assess and respond to several aspects of this project. My doctoral training was at the University of Southern California in the Biological Sciences Division (Ph.D., 1992). My research focused on the physiological ecology of marine organisms faced with varying nutritional, thermal, and life-stage conditions. My research since beginning work at the University of California, Davis (1995), and especially since joining the Department of Environmental Science and Policy (2000), has focused on the use of information about environmental, infrastructural, and social conditions in making better management and policy decisions.

In the last 15 years, I have focused my research on water quality and quantity conditions in waterways, social uses of fisheries in the Delta and throughout California, and impacts of transportation infrastructure on fish and wildlife. In that period, I have collaborated with multiple local, state and federal organizations, including: Placer, Nevada, and Sonoma Land Trusts; Napa and El Dorado Counties; South Yuba River Citizens League; Sacramento River Watershed Program; Los Angeles San Gabriel Rivers Watershed Council; Almond Board of California; California Departments of Water Resources, Conservation, Transportation, Fish and Wildlife, Forestry and Fire Protection; State Water Resources Control Board; USDA Forest Service; US Department of Transportation; and US Environmental Protection Agency.

I will address the potential impacts of the project construction on Delta wildlife, and human communities. These impacts include noise, night-time lighting, dust, circulation, aesthetics, air quality, and barrier effects. The project would cause un-mitigated impacts on communities in the region due to noise, light, and air quality pollution during construction and operations. It would cause un-mitigated impacts on terrestrial and aquatic communities, including movement and occupancy of wildlife communities I will describe why the project would be inconsistent with State-recognized sustainability principles and the policies embraced by the State in promoting integrated regional water management. In addition, I will address the

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II. **TESTIMONY**

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project's inconsistency with the 2013 Governor's Water Action Plan and the 2018 Water Plan Update currently under development.

I will explain why the proposed Delta Tunnels project (a.k.a. "WaterFix") is not in the public interest. The testimony is sub-divided in the sections below: A. Interference with Wildlife Movement: B. Negative Impacts on Human Communities: C. Incompatibility with Sustainability and Related Principles; and D. Inconsistency with Regional Water Management.

A. **Interference with Wildlife Movement**

Roads and similar linear features (e.g., cleared space beneath power transmission lines) can affect terrestrial biodiversity directly through loss of habitat and increased mortality, as well as indirectly by causing ecological changes in the road-effect zone, hindering habitat connectivity and fragmenting habitat patches. (LAND-167, Jonsen and Fahrig, 1997; LAND-175, Rosenberg et al., 1999.) Not only do developed linear features create artificial habitat edges, but they also pose a barrier to species dispersal and migration through aversion effects, direct mortality from traffic (LAND-171, Putman, 1997; LAND-174, Rubin et al., 1998; LAND-139, Alves da Rosa and Bager, 2013), and traffic/machinery light and noise-induced effects (LAND-172, Reijnen et al., 1997; LAND-159, Gill et al., 1996; LAND-164, Jaeger et al., 2005; LAND-141, Andrews et al., 2005.)

The combination of edge and barrier effects, which includes anthropogenic noise itself, can reduce the effective area for species that depend on contiguous intact habitat in the interior of patches. The Delta Tunnels analysis does not consider impacts on wildlife movement and disturbance by construction and operation of the project beyond the effects on listed/covered species. (See SWRCB-102, FEIR/S, pp. 12-3412 to 12-3787 [discussion of Alternative 4A impacts on terrestrial biological resources]; see also SWRCB-110, CEQA Findings and SOC; ECOS-8 [CDFW, Map of North Delta Essential Connectivity Areas].) In addition, bird and wildlife disturbance also depends on the frequency of the noise, not just the absolute loudness, which is not considered in FEIR/S Chapter 12.

Traffic and other human-caused noise have been used as a way to map human disturbance and its corollary, un-disturbed areas. For example, Votsi et al. (2012) used distance-criteria for human activities, including transportation noise, to map "quiet areas" important for conservation. (LAND-182.) Traffic noise (>44 dB) has been shown to explain variation in forest bird distribution. (LAND-161, Goodwin and Shriver, 2010; LAND-163, Herrera-Montes, and Aide 2011.) In addition, amphibians may be sensitive to subterranean vibration from construction, resulting in their premature emergence from burrows. Highway traffic noise has also been shown to negatively-impact bird egg-clutch size and fledgling success (LAND-162, Halfwerk et al., 2011), which would have long-term population-level effects on affected species. Birds and amphibians may be forced to adapt their communication strategy in the face of traffic and other human-activity noises by increasing rate of call, changing call pitch, or increasing amplitude. (LAND-164, Hoskin and Goosem, 2010; LAND-170, Nemeth and Brumm, 2010.)

New facility construction, or higher traffic volumes would increase the negative impacts of roadways, including aversion to roadways, fragmentation of habitat, barriers to dispersal, and direct mortality for amphibians, reptiles, mammals, and birds. These negative impacts will predictably affect subsequent willingness and ability of wildlife to move through the Delta region. Negative impacts on wildlife movement results in their disappearance from affected areas. The noise level considered as a threshold for birds and wildlife in FEIR/S is 60 dBA (SWRCB-102, FEIR/S, p. 12-3555), which is well above the threshold of ~50 dBA in the literature and in a review carried out for Caltrans on the effects of traffic/machine/construction noise on bird communication. (LAND-148, Dooling and Popper, 2007.) In addition, it is not only the absolute noise level that matters to wildlife and birds, but also the frequency of the noise, which may mask communication among individuals, or cause disruption of behavior.

Importantly, the method used by DWR for calculating traffic/construction noise propagation is entirely inadequate and does not correspond to even basic modeling approaches in GIS. (FSL-29, BDCP, Appendix 5J, Att. 5J.D, pp. 5J.D-7 to 5J.D-10.) As a result of this deficiency in DWR's analysis, it is not possible to estimate the actual impacts of

noise originating from constructing or operating the Delta Tunnels on wildlife (or people, see below). Finally, Impacts NOI-1 and NOI-2 refer to significant and unavoidable noise impacts from construction. (SWRCB-110, CEQA Findings and SOC, p.108.) Given the scale of the project, disturbance and aversion of birds and wildlife along the entire length of the project could be expected to be disturbed during at least the construction period.

B. Impacts on People and Communities

The scale of the construction and continued operation of the Delta Tunnels project is so massive that impacts to people and communities are regional, i.e., Delta-wide. These impacts are realized through health and discomfort pathways recognized in the scientific literature and have subsequent morbidity and economic consequences for those affected.

Traffic noise has been shown to be connected with negative health outcomes, including increased incidence of hypertension and specific heart ailments. (LAND-168, Lercher et al., 2011.) Noise "annoyance" (reported annoyance because of noise) has been found to occur at traffic noise levels as low as 40 dBA. (LAND-155, Freitas et al., 2012.) Traffic noise impacts and related thresholds have been used to estimate marginal health costs from increased noise from expanding roadways. (LAND-140, Andersson and Ogren, 2011.)

The Delta Tunnels' road system expansion and intake/tunnel construction would cause increases in local noise, airborne dust/particles, vehicle exhaust, and vehicle/construction lighting throughout the Delta region. Specifically, Clarksburg, Hood, and various unincorporated areas in Sacramento, Yolo, and San Joaquin counties would be subject to night-time and day-time construction noise levels above 50 dBA, which is above thresholds found to disturb human health. (See LAND-151, FEIR/S, Fig. 23A-04 and 23A-11 [noise contours from construction].) In addition, the noise impact is considered significant but unavoidable for several hundred residences throughout the region, using night-time noise levels of 50 dBA and daytime noise levels of 60 dBA. (See SWRCB-110, CEQA Findings and SOC.) The 60 dBA threshold cited throughout Chapter 23 is cited as coming from Section 01570 of DWR Specification 05-16, and no further citation is provided. Given that this DWR specification was written for impacts of noise on birds, its use in understanding impacts on

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people is meaningless. In addition, as pointed out above, more recent research (in the last decade) points to a threshold of 50 dBA for birds, which is similar to the international standard to protect human health. Also, the Leq approach used (averaging noise levels over time periods) could mask short-term peak noise levels well above 60 dBA. Finally, and most importantly, the approach used to estimate noise propagation from project activities does not use even basic methods in GIS for predicting noise propagation over mixed landscapes and through urban areas. (FSL-29, Appendix 5J, Att. 5J.D, pp. 5J.D-7 to 5J.D-10.) As a result, the actual impacts of noise originating from constructing or operating the Delta Tunnels project on human health and annoyance have not been provided.

Noise abatement measures used in various commonly-employed mitigation measures are typically only partially effective. (LAND-169, Murphy and King, 2011.) This is in part due to poor connections between known impacts and legal requirements The absence of adequate recognition of the health impacts resulting from dust, air quality, noise and light from construction and operation of road systems associated with Delta Tunnels does not mean that the impacts do not exist or that they are not significant. Despite the literature on negative health outcomes with sound levels found within the impact area (50-55 dBA), the FEIR/S only considers noise annoyance and physiological effects on hearing as impacts worth considering, which is a major deficiency in the analysis underlying the proposed project. (SWRCB-102, FEIR/S, p. 23-4.) In addition, the communities and rural households within the boundary area of noise that will cause negative health outcomes fall within NOI-1 and NOI-2, significant and unavoidable impacts (SWRCB-110, CEQA Findings and SOC, p. 108). These impacts are apparently worth the theoretically positive (albeit speculative) outcome to California of a new water supply in the North Delta: "In the Acting Director's judgment, the benefits of the Project, as set forth below, outweigh these significant and unavoidable impacts." (SWRCB-110, CEQA Findings and SOC, p. 109.) Justification for this creation of a sacrifice zone for the Delta Tunnels plainly owes much to the fact that the negative health outcomes from noise and other disturbance were not adequately assessed.

C. Proposed Project is Incompatible with Accepted Sustainability Principles

When state government entities willfully ignore sustainability principles, or pretend that we don't know how to implement them, or decide to not require sustainable actions as part of permitting for political reasons, they jeopardize the future of existing generations and future generations. The Brundtland Commission remarked upon this institutional barrier to becoming sustainable in 1987:

In the past, responsibility for environmental matters has been placed in environmental ministries and institutions that often have had little or no control over destruction caused by agricultural, industrial, urban development, forestry, and transportation policies and practices. The ability to anticipate and prevent environmental damage will require that the ecological dimensions of policy be considered at the same time as the economic, trade, energy, agricultural, and other dimensions.

(LAND-144, Brundtland Commission Report, 1987, p. 38.) In the case of the Delta Tunnels project, its primary function is to reduce alleged risks to the water supply of San Joaquin Valley agricultural interests and Central and Southern California urban areas. The potential environmental and community impacts of the project are treated as incidental and inevitable negative outcomes of business-as-usual that are mitigated if possible, and are otherwise overridden. (See SWRCB-110, CEQA Findings and SOC, pp. 106-118.) The evaluation and permitting role of the State Water Resources Control Board ("Board") should not be treated as a mere speed bump on the way to an inevitable outcome. This cynical form of governance is exactly what the Brundtland Commission warned against in the preceding quote and is directly contrary to implementing sustainability through government institutions.

Petitioners' application to USACE for a 404 permit included the following goal statement: "achieve the two coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem (California Public Resources Code Section 29702, subd. [1])" (LAND-121, USACE Permit Application, p. 2). This goal statement reflects a slightly more detailed goal statement from the Legislature: "it is the intent of the Legislature to provide for the sustainable management of the Sacramento-San Joaquin Delta ecosystem, to provide for a more reliable water supply for the state, to protect

and enhance the quality of water supply from the Delta, and to establish a governance structure that will direct efforts across state agencies to develop a legally enforceable Delta Plan." (See LAND-121, USACE Permit Application, p. 8 [citing Water Code, § 85001, subd. (c)].)

These goal statements are consistent with definitions of water sustainability and give the impression that the Delta Tunnels are intended to implement water sustainability in California. For example, in the California Water Plan ("CWP"), 2013 Update, sustainability is described as an overarching strategy for water management:

A sustainable system generally provides for the economy, the ecosystem, and social equity. Water sustainability is the dynamic state of water use and supply that meets today's needs without compromising the long-term capacity of the natural and human aspects of the water system to meet the needs of future generations.

(LAND-153, CWP, 2013 Update, Vol. 1, pp. 5-8.)

The focus of the Delta Tunnels project is on developing an additional water supply on the Sacramento River to meet contractual needs south of the Delta. This is not the same as a consideration of the most sustainable practices that should be employed at the regional and state scales to meet water needs. Instead of institutionally considering the relative sustainability of the project, the project is treated as inevitable, meeting the un-questioned and inevitable desires of water users to the south, and inevitably resulting in negative impacts associated with the project's development.

Because the Delta Tunnels project would be impacted by future changes from climate change and because sustainability is by definition about how current actions impact future generations, it is worth determining how the Delta Tunnels project would address climate change. But rather than addressing the uncertainty associated with climate change as a planning principle or objective, climate change is used as a rationale for a typical engineered solution that may or may not meet the conflicting goals of protecting water transfers southward and the environment. The underlying idea is that because climate change will exacerbate conflicts over water passing through the Delta due to more extreme conditions, Delta Tunnels

would attempt to sidestep the escalating conflicts through a traditional, engineering-centered project.

In many ways, this is the opposite of sustainability, which is typically defined as recognizing and dealing with potential conflicts rather than side-stepping them. If the Delta Tunnels really are a sustainability choice, then it should be obvious how the project would maximize benefits across the ecological, economic, social and management domains now and in the future, rather than being a hotly-contested litany of partially-mitigated impacts on these same domains.

Few actions in either the CWP or the Delta Tunnels documentation are described in sufficient detail to enable one to measure whether or not sustainability would be achieved, or whether those actions are even consistent with sustainability objectives. The closest that either comes is the Water Sustainability Indicators Framework in the CWP. (LAND-153, CWP, 2013 Update, Vol. 1; see also LAND-177, Shilling, 2014 [water sustainability indicators framework Phase I report]; LAND-178, Shilling, 2014 [water sustainability indicators framework Phase II report].) I developed this Framework in collaboration with state and federal scientists, including scientists from DWR and the Board, in order to provide a method to measure the relative sustainability of environmental, social, economic, and management conditions. (LAND-176, Shilling et. al., 2015.) Although DWR staff have repeatedly stated during 2018 Update meetings that they continue to examine sustainability indicators, they have decided to delay actually measuring sustainability until the 2023 Update. (LAND-149, CWP, 2018 Update Preliminary Draft.)

One could argue that sustainability is just a general concept, or that not enough is known about it to require development of sustainability policies or management actions that measurably led to sustainable outcomes. These cynical, or pessimistic outlooks are not consistent with the original concept of sustainable development laid out in the 300-page Brundtland Commission Report, nor are they consistent with DWR's own 2013 CWP Update descriptions of how sustainability should be used.

DWR has continued much of the descriptive language in the CWP 2013 Update through to the 2018 Update. For example, the following idea that was developed by DWR CWP staff is becoming ensconced in the 2018 Update:

Sustainability is not a destination, but rather a direction that must constantly be monitored, evaluated, acted upon, and adjusted. While it is not possible to achieve or demonstrate sustainability at a point in time, trends and patterns observed over time can demonstrate movement toward or away from sustainability.

(LAND-150, CWP, 2018 Update Sustainability Handout.) Two important aspects of this statement are that we should not expect to become sustainable, which is a socially and institutionally flawed concept, and that we should measure progress toward sustainability. For the Delta Tunnels project, there appears to be no attempt to demonstrate the relative sustainability of the overall project at the region or state scale, or suggestion of performance measures/indicators that would permit this type of evaluation. DWR goes further and suggests that "moving California towards more sustainable outcomes requires a long-term, consistent, and self-correcting planning and policy-making framework." (LAND-150, CWP, 2018 Update Sustainability Handout.)

State entities, including both the permit applicants and the permitting agencies could argue that sustainability is not in their mission statement or operating requirements and that the detailed descriptions of the desirability and necessity of sustainability amount to no more than a vague planning goal rather than imposing any legal requirements. However, the actions taken as part of the Delta Tunnels project appear unlikely to protect the Delta ecosystem, or restore and enhance it, and in general the FEIR/S only describes the water supply need for the project and the potential success of mitigation for harmful impacts. Because of its size, cost, and regional/inter-regional importance, it would affect both regional and state-scale sustainability.

The Delta Tunnels project does not explicitly use sustainability principles, objectives, and clearly defined measurement goals for ecological, economic, and social domains. Again, because of its massive scale, any discretionary decision allowing the project to proceed should

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be conditioned to include measured demonstration of its relative sustainability following best available science, prior to awarding a permit. (See 23 CCR, § 5001, subd. (f) Appendix 1A.) This could start with application of the well-vetted, several dozen sustainability indicators demonstrated within regional pilot projects for the CWP 2013 Update.

D. Regional Water Management Impacts

California has invested heavily in the concept of integrated regional water management (IRWM), which is defined as "a collaborative effort to identify and implement water management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives." (LAND-152 [DWR's IRWM online homepage].) This is more than a principle; DWR also advocates for regions deciding their path for water management:

IRWM enables self-identified regions to integrate and implement water management solutions for their region, which is a foundation of Action 2: "Increase regional self-reliance and integrated water management across all levels of government," in the California Water Plan...The fundamental principle of IRWM is that regional water managers, who are organized into regional water management groups (RWMGs), are best suited and best positioned to manage water resources to meet regional needs. While large inter-regional water management systems, such as the State Water Project, Central Valley Project, and flood management systems, are important, the majority of California's water resource management investments are made at the local and regional level. IRWM has been critical in helping meet California's water management challenges, including the 2014 drought.

(LAND-152.) IRWM is more than just a good idea on the part of CDWR, it has also been embedded in California law since 2002. (Regional Water Management Planning Act, SB 1672). The legal Delta used in FEIR/S is within 4 separate IRWM regions: San Francisco Bay Area, East Contra Costa County, Eastern San Joaquin, American River Basin, and Westside (Yolo, Solano, Napa, Lake, and Colusa counties). (See LAND-154 [map of planning regions as of August 2017].) All of this points to the importance of considering the Delta not just as pinch point in the transfer of water southward, but also as its own special place with its own economic activities, ecological processes, and social networks.

DWR's Water Management Tool¹ demonstrates that the project area overlaps medium and high priority groundwater basins and a critically over-drafted basin. (See Figure 1 below.) In addition, the Sacramento River north of the intakes is not a concrete-lined channel and naturally has hyporheic connections with groundwater along its entire passage through the Sacramento Valley, which is entirely across medium and high priority basins. The US Geological Survey has long described surface and groundwater as essentially a single resource: "In many situations, surface-water bodies gain water and solutes from ground-water systems and in others the surface-water body is a source of ground-water recharge and causes changes in ground-water quality." (LAND-138, Alley et al., 1999; see also SJC-251, USGS Groundwater Circular.)

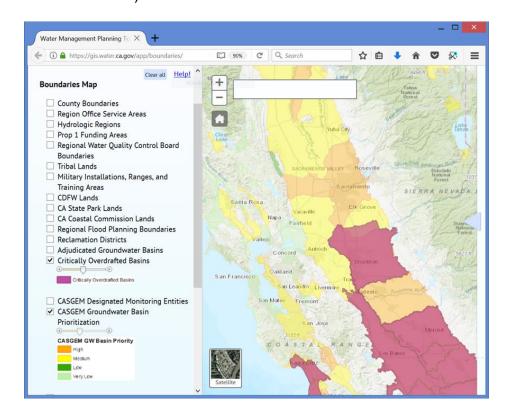


Figure 1. Priority and Critically Overdraft Basins within the project area and upstream.

Public law clearly describes the Delta as both a region with its own values and a place meeting the needs of California; according to the Delta Reform Act of 2009 (Delta Reform Act), the State has:

¹ Available at: https://gis.water.ca.gov/app/boundaries/. Figure 1 was created using this tool.

'Coequal goals' (which) means two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

(Water Code, § 85054.) If state and inter-regional projects are designed to benefit regions distant from water sources and come at the expense of local/regional priorities, then the very idea of integrated regional water management loses its meaning.

The Greater Los Angeles County Region Integrated Regional Water Management describes the region's reliance on the Delta as a water source, as well as local, recycled, LA Aqueduct and Colorado River sources. (LAND-187, pp. 2-29 to 2-31 [regional description of Los Angeles County].) In addition, as part of buffering against future drought years, the Metropolitan Water District has used imported water in spreading basins to augment local groundwater storage: "In addition, many groundwater basins in the San Francisco Bay Area, Central Coast, and Southern California rely on SWP/CVP surface water to recharge groundwater basins." (SWRCB-102, FEIR/S, p. 7-117.) The region also depends on interregional water transfers, as do agricultural interests in the San Joaquin Valley.

These transfers have historically passed through the Delta to the existing pumps located in the South Delta, and are then conveyed southward. Transferring water through the Delta from irrigation/water districts in the Sacramento Valley to southern clients differs dramatically from the transfer mechanism proposed by proponents in that under a through-Delta transfer system the Delta receives benefits from this water being present in a way that emulates natural flows. If the transferred water is withdrawn north of the Delta and transferred southward through the proposed tunnels, then the Delta will receive no benefit from water flows. In dry years it is likely that Colorado River, LA Aqueduct, and local sources of water will be limited to meet LA's water appetite and pressure will be great to maximize flows through the north intakes, rather than through the Delta. In addition, southern Central Valley irrigation desires met through the new intakes will be greater in dry years and political pressure will be similarly greater to meet these desires through the new intakes. This is reflected in anticipated increases in exports under Alternative 4A to the San Joaquin Valley, Tulare Lake, Central

Coast, and Southern California hydrologic regions. (SWRCB-102, FEIR/S, p. 7-123 [Table 7-8].)

The Sustainable Groundwater Management Act, 2014 ("SGMA"), requires local agencies and users of groundwater to develop plans to sustainably use groundwater, with priority given to certain basins. (Water Code, § 10727.) These basins and corresponding basin planning are analogous to regions and regional planning and are intended to manage water that has both physical connections and management use/dependencies on surface water systems and availability. But if regional planners and users can't control the removal of water from the area of the basin, as would be the case during operation of the proposed North Delta intakes, their ability to meet SGMA requirements would be hampered. The FEIR/S describes groundwater impacts, including recharge and quality of groundwater in the Delta region as significant and unavoidable. (SWRCB-110, CEQA Findings and SOC, p. 106 [impacts GW-6, GW-7, GW-9].) However, if these impacts also impair the ability of Delta region water managers to follow IRWM principles and actions and to meet the requirements of SGMA, then they extend into other regulatory and statutory areas well beyond CEQA.

III. CONCLUSION

In my opinion, the changes proposed in the Delta Tunnels petition will unreasonably affect fish and wildlife, human well-being in regional communities, regional water management, and both regional and state-scale water sustainability. These impacts will originate from the scale and position of the intakes in the North Delta, near communities and upstream of Delta waterways and farming areas. They will also originate from the management of a regional water system to support needs of other regions, regardless of the effects on the Delta. Finally, the impacts originate in a philosophy that sacrifice zones may be necessary to meet state objectives, which suggests that public trust resources are only protected when expedient.

Executed on the 30th day of November, 2017, at Sacramento, California.

Fraser Shilling, Ph.D.

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